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The Montana Timber Market Model—A User's Guide

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ABSTRACT

The Montana Timber Market Model is a computer simulation model designed to evaluate how various harvest and log-processing scenarios will affect timber resources and economics. It covers the State of Montana or three substate regions (northwest, southwest, and central) for lands managed by the USDA Forest Service, Montana Department of State Lands, forest industries, nonindustrial private owners, and other public owners. The model provides flexibility in selecting harvest levels and other assumptions. Output consists of printed reports covering changes in timber inventory, stumpage prices, employment impacts, and other economic or inventory-related information.

KEYWORDS: supply and demand, modeling, computer simulation, timber supply projection, policy analysis

INTRODUCTION

The Montana Timber Market Model (MTMM) is an interactive computer simulation model designed to estimate future timber stumpage prices, stumpage supply and demand, timber-dependent changes in employment and income, and to monitor changes in various characteristics of Montana's timber resource. MTMM estimates are based on several assumptions, such as future harvest levels, lumber prices, production costs, starting timber inventory, growth rates, and overrun. MTMM allows the user to assess the timber resource and market implications of various management and policy options.

This user's guide describes the structure of MTMM and its use. The structure of the model is first described in general terms. This is followed by a summary of the steps required to produce a simulation. Each of these steps is then described in detail.

OVERVIEW OF MODEL STRUCTURE

The operation of MTMM can be described in five steps:

1. Initial values are assigned to all variables.
2. The interactive part allows the user to:
   a. select statewide timber processing level,
   b. select harvest level by ownership class and substate region, and
   c. inspect and/or change the default values of variables.

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3. Information about the starting timber inventory is automatically read into the program and adjusted according to harvest alternative selected by user.
4. A 55-year forecast period is started. During each annual iteration through the period, the following steps occur:
   a. timber harvest volume is calculated for lands managed by the Forest Service, total statewide harvest, and non-Forest Service ownership classes,
   b. the inventory volume is compared to the selected harvest strategy and the simulated harvest is reduced if inventory volume is less than the harvest specified,
   c. the simulated harvest is "transported" from origin to destination, based on 1980 log movement data,
   d. total revenue from harvesting is calculated based on stumpage price and harvested volume,
   e. timber employment and income impacts are calculated based on the substate regional harvest,
   f. the timber inventory data are adjusted to account for harvest and growth,
   g. reports are written to the output file, and
   h. economic information is updated.
5. After the simulation period is finished, the reports are summarized and the program stops.

The MTMM has both biological and economic components. The biological component contains information used to simulate timber inventory. The economic component contains information used in economic projections of market performance and features of the wood products industry. It provides information on statewide log processing levels and on the timber volume to be harvested, where, and by which ownership class, based on the selected harvest-related scenarios. The biological component uses that harvest information, adjusts the timber inventory data to reflect changes resulting from the specified harvest, and adjusts growth at the residual stand.

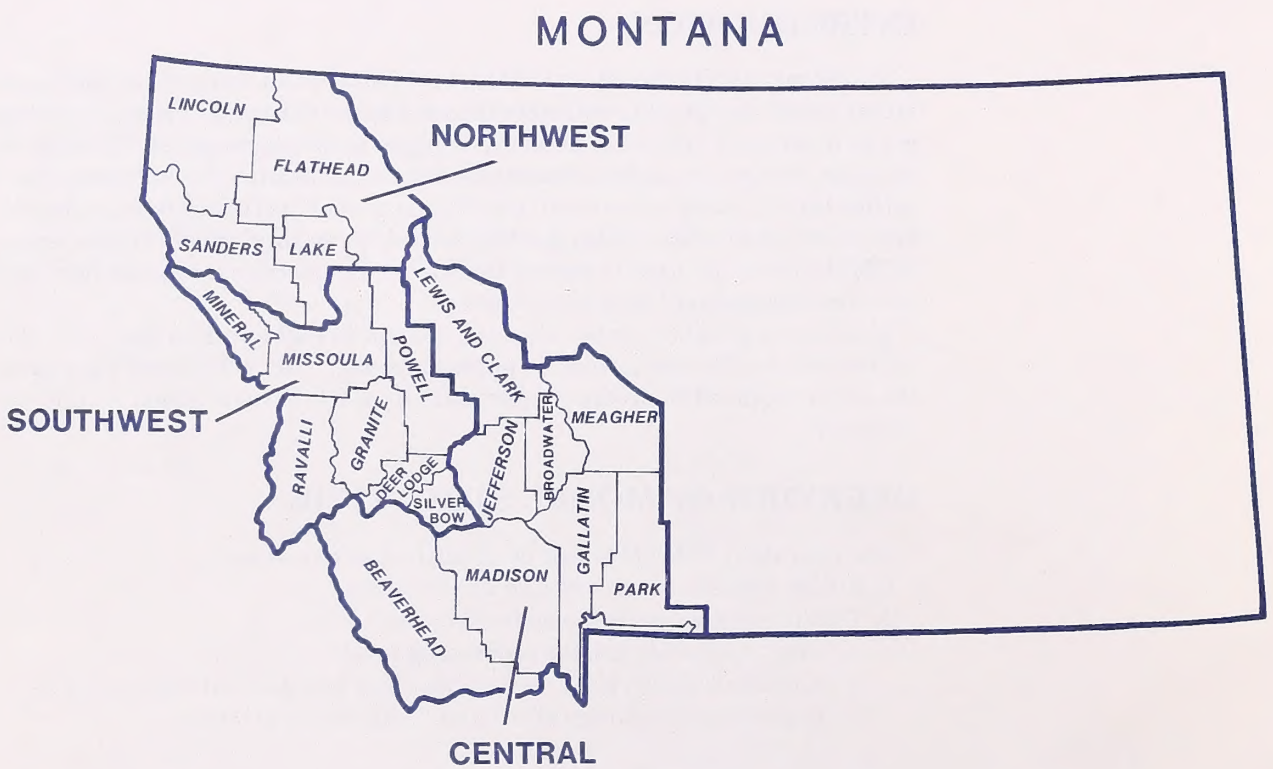

Figure 1—Multicountry regions used in study.

The following provides a more detailed look at how MTMM simulates future inventory, timber processing, timber harvest, stumpage price, and employment and income.

Inventory

The statewide timber inventory is divided into two parts. In one part inventory characteristics change over time and in the other part they remain fixed. The changing timber inventory pertains to four owner classes: Forest Service, forest industry, Montana Department of State Lands, and nonindustrial private. Each ownership class is further broken down into three geographic areas (fig. 1): northwest, southwest, and central. For each ownership class area combination, there is an inventory described in cubic feet (CUFT) by 2-inch diameter classes (6 inches to 30+ inches). These volume estimates are derived from two sources: Forest Service data are from the 1979 assessment (Laux 1986) and the non-Forest Service information from the 1979 Montana statewide inventory (Long 1986). All inventory data have been updated to 1985 based on known, historical harvest levels and estimated growth rates. The current version of MTMM does not allow the user to update the timber inventory to other years. Forest Service data were aggregated into the three geographic areas according to the percentage of each National Forest's acres in each substate region. The timber inventory is updated yearly, using growth rates by diameter class, and ownership class, and geographical area.

A portion of the statewide inventory was assumed constant, or fixed, because the available inventory data were either nonexistent or suspect. All owner/area combinations not described above were treated within the fixed component of the statewide inventory: the Bureaus of Indian Affairs and Land Management, U.S. Department of the Interior; other public, such as county or municipal owners; and all ownership in eastern Montana. This component of the inventory remains unchanged throughout MTMM simulations in that there are no yearly growth or cut updates. As a result, 16 percent of the statewide inventory is treated as fixed, while 84 percent is modeled dynamically.

The inventory accounting method can be broken down into the following steps:

1. The initial inventory is lowered to compensate for acres that are nonoperable, based on logging technologies and harvest selection.
2. The harvested volume is increased by 12 percent to account for unutilized material and growing stock lost due to logging damage (adapted from Howard and Fiedler 1984). The total harvest is distributed to diameter classes based on a "cut profile," a rule describing the percentage distribution of cut by diameter class. The harvested amount is deducted from the inventory. If the desired volume cut in a diameter class is more than the inventory available, the shortage is made up from the next lower diameter class.
3. Annual growth is calculated and added into the inventory. Also, "ingrowth" (movement from one diameter class to another) is added into the 6-inch diameter class.
4. Finally, outgrowth, the transfer of trees from one diameter class to the next larger diameter class, is performed.

Timber Processing Levels

The timber processing levels represent the targeted, annual amount of timber volume to be processed by the mills in Montana. MTMM has four methods for depicting mill processing levels: supply and demand equations, historical long-term trend, historical short-term average, and full mill capacity. The supply and demand equations are based on data from 1962 to 1985 (Connaughton 1987). Because equations are sensitive to both Forest Service harvest and non-Forest Service growing stock inventory levels, there will be a different equilibrium solution for each combination of harvest levels. The long-term trend and the short-term average processing levels were based on 15 years (1970-84) and 5 years (1980-84) of harvest data, respectively (Niccolucci 1986). The long-term trend estimates are from a regression equation; the short-term average is the mean of the five harvest estimates. Harvest data were converted into levels of timber processing for each

substate region by accounting for log movements from timber-cut origin to log-processing destination. Mill capacity refers to the theoretical maximum annual volume of logs that mills could use at full production. Actual mill capacity is typically 70 to 90 percent of full capacity level. Estimates of mill capacity and log movements were obtained from the Bureau of Business and Economics Research, University of Montana (Keegan 1986).

Timber Harvest

Seven approaches were used to portray the levels of timber harvest, four related to Forest Service lands and three related to non-Forest Service. The four Forest Service alternatives are labeled "high market," "preferred," "high non-market," and "short-term average." Except for the short-term coverage, Forest Service harvest volumes were developed from information contained in the draft or final forest plans (table 1). The forest plan alternatives selected for the "high market" generally emphasize timber production while those selected for the "high non-market" generally emphasize production of amenities and other nontimber outputs. The "preferred" set consists of those alternatives identified by each National Forest as the preferred forest plan alternative. The short-term average harvest was based on 5 years (1980-84) of actual Forest Service harvests.

Timber harvest from the non-Forest Service ownership classes can be specified in three ways: "cut equals percent of inventory," "cut equals growth," and "cut equals short-term average." The calculation of the "cut equals percent of inventory" is done within MTMM by first calculating the total cubic feet (CUFT) inventory of trees greater than 8 inches d.b.h.for each non-Forest Service ownership/area class. The harvest level by ownership/area is determined by estimating the percentage that each ownership/area's sawtimber inventory comprises the total non-Forest Service harvest. If the "percentage of inventory" approach is selected, it must be used for all geographical areas (State and substate) and each non-Forest Service ownership class.

Table 1—Montana Timber Market Model Forest Service harvest specification

Alternative labels from forest plan				Percent of forest by substate region		
National Forest plan	High market	Preferred	High non-market	Northwest	Southwest	Central
Beaverhead (Final 1986)	B[1]	H	D	—	0.07	0.93
Bitterroot (Draft 1985)	A	E	J	—	1.0	—
Custer (Draft 1985)	7	6	8	—	—	.03
Deerlodge (Draft 1985)	C	M	J	—	.63	.37
Flathead (Final 1985)	2	11	16	0.80	—	.18
Gallatin (Draft 1985)	2	7	3	—	—	.86
Helena (Final 1986)	C	E	G	—	.17	.83
Lewis and Clark (Final 1986)	A	G	C	—	—	.43
Lolo (Final 1986)	C	D	J	.24	.72	—
Kootenai (Draft 1985)	L	J	F	1.0	—	—

[1]Readers interested in exact descriptions of each alternative should consult the appropriate draft or final Environmental Impact Statement for each Forest.

The last two harvest options may be mixed between owner classes and substate regions. "Cut equals growth" is calculated by summing for each owner/area the board feet (BDFT) growth across diameter classes for trees greater than 8 inches d.b.h. The ownership/area harvest is equal to total BDFT growth for each owner/area. The last non-Forest Service harvest option is "short-term average," where harvest equals the average harvest from 1980 through 1984 for each owner/area.

Stumpage Price

When the supply and demand log processing option is selected, the equilibrium stumpage price and quantity are estimated with supply and demand equations (Connaughton 1987). When total demand exceeds selected harvest levels, the stumpage price is reestimated using the demand equation. For other timber processing options, stumpage price is estimated using the demand equation only. The demand equation requires estimates for the lumber and wood product price and manufacturing, logging, and hauling costs. Projections for these variables were produced by the Timber Assessment Market Model (Adams and Haynes 1980; Haynes 1986). All prices are expressed in 1985 dollars.

Employment and Income

All economic impact multipliers used to estimate employment and income effects come from IMPLAN (Alward and Palmer 1983), the Forest Service's secondary data, input-output modeling system. Multipliers are backward-linked, Type II. Changes in technology and gains in production efficiency will undoubtedly change these multipliers over time, but because these changes could not be predicted, multipliers could not be updated. Individual employment and income multipliers are used for the northwest, southwest, and central regions, and eastern portion of Montana. All incomes are expressed in 1985 dollars.

CREATING AN MTMM SIMULATION

MTMM program execution can be divided into four steps:

1. Start the MTMM program and, if desired, view the general description of model and program.
2. Enter required information:
   a. Statewide timber processing levels
   b. Forest Service harvest by area (NW, SW, CTL)
   c. Non-Forest Service harvest by owner (DSL, IND, PVT) and substate regions (NW, SW, CTL)
3. Inspect and/or change, as necessary, model's default assumptions.
4. Select desired reports, enter an output file name, and print reports after the simulation is finished.

Beginning MTMM Simulation

NOTE: In this user's guide, the outlined area represents screen output written by the computer. A screen refers to a menu or a page of writing that is written to the computer terminal. The symbol " " designates the user-provided response for the question, to be followed by pressing the "Return" key. Throughout this guide, reference will be made to the "Return" key on the computer keyboard; depending on the keyboard, this key may be labeled "Carriage Return," "Enter," "New Line," and so on.

Once execution has started (that is, PC user typing "MTMM" followed by a "Return" or Data General user typing "X MTMM" followed by a "New Line"), the following will appear on the screen:

```
                                    MTMM

                          Montana Timber Market Model

   This software was developed through a cooperative research agreement
   between the U.S. Forest Service, Intermountain Research Station, and
   the Montana Department of State Lands and remains as public property
   and belongs in the public domain.


                        Original programming James D. Cook, 1982
                           Revised James F.C. Hyde III, 1986
                         Current revision William L. Wood, 1988

                          (Timber inventory updated to 1985.)


                      The user is encouraged to study the user guide.

                  Press the "Return" ("Enter" or "New Line") key to continue.
```

The second screen contains the following statements:

```
Enter code:
   1) To view introductory information about MTMM
   2) To enter Required Information, starting with timber processing levels
>> 2
```

The user selects "1" to view the opening screens that describe how to run the program and the basic structure of the model. First-time users should select "1". The user should enter "2" to start creating an MTMM simulation.

Entering Required Information

When the user selects the code "2" on the second screen, MTMM responds with a series of questions that must be answered to produce a simulation. The user must specify: statewide timber processing level, Forest Service harvest level, and finally non-Forest Service harvest level.

Statewide Timber Processing Levels—There are four methods available for specifying the processing levels—supply and demand equations, long-term trend, short-term average, and full mill capacity. The user will see and respond to the following screen next:

```
                          REQUIRED INFORMATION

   Enter code for statewide timber processing level:
          1) Supply-demand model
          2) Other (long-term trend, short-term average
             or full mill capacity)
   >> 2
```

If the user selects "1", the supply and demand model approach will be used to estimate statewide and regional processing levels. If "2" is selected, then processing levels are individually selected for each region and the following appears on the screen:

```
Enter code for substate region timber processing levels:

                                NW   SW   CTL  EAST
Supply-demand                   --   --   --   --
Long-term trend                  2    2    2    2
Short-term average               3    3    3    3
Full mill capacity               4    4    4    4

Enter      NW          >> 2

Enter           SW          >> 3

Enter                CTL         >> 2

Enter                     EAST       >> 2

Verify entries : NW =  2 SW =  3 CTL =  2  EAST =  2

   Enter (1) if correct or (2) to reenter values >> 1
```

After the user enters the required timber processing information, the values selected will be relisted on the screen. The user is asked to verify the previously entered values. If these values are correct, respond with "1". If the user wishes to reenter the desired processing levels, select "2". Once a "1" is entered, the next screen will appear and the user will be asked to enter Forest Service harvest levels.

Forest Service Harvest—The Forest Service harvest options are labeled "high market," "preferred," "high non-market," and "short-term average." Alternatives are specified for each of the substate regions. The user must respond to the following:

```
Enter code for desired Forest Service cut alternative by substate region:

                                NW   SW   CTL
High market                      1    1    1
Preferred                        2    2    2
High non-market                  3    3    3
Short-term average               4    4    4

Enter      NW          >> 1

Enter           SW          >> 2

Enter                CTL         >> 1

Verify entries : NW =  1 SW =  2 CTL =  1

Enter (1) if correct or (2) to reenter values >> 1
```

Once again the user selects "1" to move on to the next screen, selecting non-Forest Service harvest, or "2" to reenter Forest Service harvest options. Timber harvested from Forest Service land in the eastern portion of Montana is constant over time and is added to the total harvest level for the East.

Non-Forest Service Harvest—There are three options for determining the non-Forest Service harvest level: percentage of inventory, cut equals growth, and short-term average. The following will appear:

```
Enter desired Non-Forest Service statewide cut alternative:
       1) Cut = percent of inventory
       2) Other (Cut = growth or cut = short-term average)
>> 2
```

If "1" is entered, "cut = percent of inventory," the next set of screens will not appear because this harvest option automatically applies to all regions and owners. If "2" is entered, the user must specify the harvest by each owner and substate region.

```
Enter code for Department of State Lands cut by substate region:

                                  NW   SW   CTL
      Cut = % of Inventory        --   --   --
      Cut = growth                 2    2    2
      Cut = short-term average     3    3    3

         Enter      NW          >> 2

         Enter           SW          >> 3

         Enter                CTL         >> 2

       Verify entries : NW =  2 SW =  3 CTL =  2

    Enter (1) if correct or (2) to reenter values >> 1
```

This question is repeated for all non-Forest Service owners: forest industry and nonindustrial private.

Reviewing and Changing Default Assumptions

After all required information is entered, the user has the option to inspect and/or change information describing various key assumptions within MTMM. Each assumption consists of a set of default values that will be used in all simulations, unless the user specifies different values. Each time MTMM is executed, the assumptions revert to their default values. It is important to note that MTMM does not check for extreme combinations or illogical variable values, which could cause the program to terminate execution.

The following screen will appear and gives the user the option to inspect and/or change default values:

```
                    OPTIONAL SECTION

The following types of information are used by MTMM
to make all operations and calculations.  All needed
information is already contained within the model.  You may
inspect and/or change information in any of these areas:

    1. Short-term harvest levels; by owner/area
    2. USFS harvest levels & area distribution for preferred alternative
    3. Overrun
    4. Harvest costs and revenues
    5. Harvest biology
    6. Forest Service growth rates
    7. Non-FS growth rates, ingrowth rates, & BDFT/CUFT growth ratios
    8. Non-FS land adjustments
    9. Forest Service land adjustments
   10. Cut profiles
   11. "Others" cut or inventory
   12. Acreage characteristics
   13. Impact multipliers
   14. Log flows
   15. No inspection and/or change has been compeleted.

Enter appropriate code >> 15
```

The interactive sequence for changing and/or inspecting default assumptions is:

1. If no inspection and/or change is desired, enter "15". Otherwise, enter the number corresponding to the variable of interest and follow subsequent instructions.
2. Review the default values for the selected variable listed on the screen.
3. If the set of default values is acceptable or correct, enter "1" and return to OPTIONAL SECTION menu. If the user desires to change any of the default values, enter "2".
4. If a "2" is entered, the variables are again listed one at a time on the screen; the respective default value is listed in the parentheses.
5. If the default value shown is correct, press the "Return" key; if a new value is desired, it should be entered.
6. Once all default values have been confirmed or revised, the screen will clear and a listing of the user-specified values, either new or default values, will appear on the screen for verification.
7. If a value was entered incorrectly, enter a "2" and reedit the variable. If the values are correct enter a "1", return to the OPTIONAL SECTION menu, and repeat step 1.

The 14 variables that can be edited by the user are:

Variable 1: Short-Term Harvest Levels; – by Owner/Area—This allows the user to view and edit the short-term harvest levels specified for each ownership/area combination. To view or edit these values the user must have previously selected the short-term average for the desired ownership/area harvest option.

Variable 2: USFS Harvest Levels & Area Distribution for Preferred Alternative—This variable enables the user to view and edit two variables: (1) percentage distribution of National Forest timber harvest to substate regions and (2) the harvest level associated with the preferred alternative for each National Forest. To use this option the user must have previously selected the "preferred alternative" harvest option for at least one of the Forest Service substate regions. Changes are permitted in only the substate regions where the Forest Service preferred alternative option was selected. The default percentages reflect the number of acres in the substate region. These acreage estimates are the same as those used by the Forest Service to distribute the 25 Percent Fund payments to counties, the distribution of net National Forest acres within counties. If the user believes these acreages do not reflect harvest distribution, different percentages can be entered. A change in these percentages will affect only the distribution of harvest to a substate region and not the inventory. The Forest Service harvest levels are the annual harvest level from the preferred alternative for the following years—1985, 1990, 2010, and 2030. The annual harvest for years not entered is estimated by trending the harvest value at the beginning and ending of a time period.

Variable 3: Overrun—The user has two options for projecting overrun. The first option uses the default overrun projection method but allows the user to edit the default variable values. In the default method (Carr 1986; Moore 1986), overrun is trended linearly from 1.5 (or 50 percent overrun) in 1984 to 1.7 in 1994 and then to a peak of 1.8 in 2004. The maximum overrun allowed is 1.8. The second option is to enter estimates for overrun by 5-year intervals, and the program will interpolate to identify intermediate values. Overrun is only used in the supply and demand equations.

Variable 4: Harvest Costs and Revenues—This variable allows the user to change and/or view a series of economic assumptions. These include: (1) the ratio of timber volume offered for sale to volume sold for the Forest Service sales (variable affecting the supply and demand equations); (2) the estimate for the lumber and wood products price; (3) the estimate for the logging, hauling, and manufacturing cost; (4) the premium added to Forest Service stumpage price to represent non-Forest Service stumpage in 1985 dollars; and (5) the annual compound rate of increase for both lumber and wood product prices and the logging, hauling, and manufacturing costs.

Variable 5: Harvest Biology—This allows the user to edit or view a series of harvest biology assumptions. These include: (1) the annual reduction in total forest land base due to conversion of forest land to subdivision, agriculture, or other uses; (2) the estimate for the cubic-foot volume per acre of trees entering the 6-inch diameter class; (3) the number of years it takes a harvested acre to grow back into the 6-inch diameter class; (4) the number of years to reintroduce all the seedling/sapling acres back into the 6-inch diameter class; and (5) the percentage that growth rates will increase in the future because of better management practices, and the year such an increase would begin.

There are two methods to begin a permanent increase in the future growth rates. (If the user wants to increase the starting **growth** rates, go to variables 6 and 7.) In the first method, enter "% improvement in growth rates," a uniform improvement is applied to both Forest Service and non-Forest Service owners and all substate regions for the specified year. Example: If the user believes that by the year 1990 better management should increase the growth rate by 50 percent, he/she would enter a 50-percent improvement in the year 1990. The growths will increase by 50 percent and remain at that level throughout the rest of the simulation. In the second method, enter "% improvement in growth rate by owner and DBH," the user must specify the d.b.h. class, owner/area, and year to apply the

improvement. Only one method for increasing growth can be used for a given simulation run. The growth rate changes specified here are applied to the default or specified values for variables 6 and 7.

Variable 6: Forest Service Growth Rates—This enables the user to edit the starting growth rate estimates for Forest Service inventory by substate region and by d.b.h. class. The default growth rates were estimated from the 1979 Forest Service assessment data.

Variable 7: Non-Forest Service Growth Rates, Ingrowth Rates, and BDFT/CUFT Growth Ratios—With this option the user can inspect and/or change the 1979 statewide inventory estimate of: (1) non-Forest Service starting growth rates by d.b.h. class and substate region, (2) ingrowth by d.b.h. class and substate region, and (3) the ratio of BDFT/CUFT for growth volume. Ingrowth is the percentage of volume growing from one diameter class into the next larger class. One set of ingrowth estimates was used for all ownerships. The ratio of BDFT/CUFT is the ratio used to convert the cubic growth into board-foot growth.

Variable 8: Non-Forest Service Land Adjustments—This allows the user to edit or review adjustment percentages for volume of timber available on non-Forest Service lands. The non-Forest Service inventory is adjusted to remove timber volumes located on land that is not available for harvesting. The default estimates reflect only physical limitations to timber harvesting and do not take into account landowners who choose to not allow timber harvesting. These percentage adjustments, however, can reflect whatever factors the user considers important.

Variable 9: Forest Service Land Adjustments—This allows the user to edit or view the Forest Service land adjustment factors. These factors vary by Forest Service harvest alternative. The adjustments were based on the suitable land base identified in the forest plan alternative divided by the acreage used in the 1979 assessment inventory. To be meaningful, land base adjustments and harvest schedules must be synchronized to a specific forest planning alternative.

Variable 10: Cut Profiles—With this variable the user may edit or view the cut profile for either the Forest Service or non-Forest Service ownership by d.b.h. class. The cut profile is used to calculate the volume removed from each d.b.h. class. The total cut profile represents the percentage distribution of timber harvest across all d.b.h. classes and therefore must sum to 1.0 (or 100 percent). The cut profile is multiplied by the owner/area harvest to calculate the volume removed from a d.b.h. class in the inventory.

Variable 11: "Others" Cut or Inventory—This variable permits the adjustment of "Others" inventory or cut. This portion of the statewide inventory ("Others") was assumed to remain unchanged because inventory data needed to simulate inventory changes was either nonexistent or suspect. The "Others" inventory consists of growing stock for the Bureau of Indian Affairs, Bureau of Land Management, and all ownerships (including Forest Service) in eastern Montana. Also, there is a growing stock variable, ADJSTK, which can be used to calibrate the supply and demand equations.

The following owner and areas have a fixed harvest level: Bureau of Indian Affairs, Bureau of Land Management, and all ownerships in the east. The Bureau of Indian Affairs harvest is further divided into northwest and southwest harvest. The Bureau of Land Management harvest is divided into southwest and central harvests. These harvests are added into the regional harvest and log delivery estimates.

Variable 12: Acreage Characteristics—This variable allows the user to edit two sets of variables. The first set is the percentage of land harvested by "clearcut" and the associated volume per acre harvested. These data are used to convert

the harvest volume into acres harvested. If greater (or smaller) clearcut percentages are assumed or lower (or larger) volume per acre, the resulting acres harvested in the model will increase (or decrease). The acres harvested are returned to the inventory after 35 years (the default value) or whatever other level is specified in variable 5. The second set of variables is estimates for the number of seedling/sapling and nonstocked acres. These acres are brought back into the inventory base at the rate selected in variable 5.

Variable 13: Impact Multipliers—This variable permits viewing or entering new estimates for income and employment impact multipliers (for the timber sector and the total economy). Unique employment and income multipliers are used for the northwest, southwest, central, and east. These figures are multiplied by the regional total for harvest to estimate the timber (direct) and total (direct + indirect) income and employment.

Variable 14: Log Flows—This variable allows the user to edit or view the log flow estimates. Log flows are the movement of logs from one geographical area (origin) to another (processing destination). The model calculates regional processing or timber deliveries by using log flow percentages and regional harvest. The log processing total for a region, such as the northwest, is a function of the percentage of timber that is cut and processed there, plus the percentage of timber cut in other regions but processed in the northwest region. There is also a percentage to account for imports into the region from out of State. Report #5 REGIONAL SUPPLY VOLUME BDFT has the regional and State total harvest adjusted for log flows. For comparison the regional and State timber processing levels are listed too.

Variable 15: No Inspection and/or Change Has Been Completed—If the user has completed or does not want to edit or inspect any of the default values, then a "15" is entered. The user then continues to the next section.

Selecting Reports

The final step the user must take to produce a simulation is to select desired output reports and enter the output file name. After completing the editing of default values, the following screen appears:

```
                    REQUIRED REPORT SELECTION
   Must choose at least ONE REPORT. Maximum number is 15.
Report # =  1   STATE SUMMARY PAGE 1            Standard report.
Report # =  2   STATE SUMMARY PAGE 2            Standard report.
Report # =  3   OWNER VOLUME CUT BY YR BDFT     Standard report.
Report # =  4   OWNER SHORTFALL BY YR BDFT      Standard report.
Report # =  5   PROCESSING  VS. DELIVERY        Standard report.
Report # =  6   EMPLOYMENT & INCOME REGIONAL    Standard report.
Report # =  7   EMPLOYMENT & INCOME TOTALS      Standard report.
Report # =  8   OWNER GROWING STOCK BY D.B.H    Standard report.
Report # =  9   OWNER INVENTORY BY YR CUFT      Standard report.
Report # = 10   OWNER INVENTORY BY YR BDFT      Standard report.
Report # = 11   OWNER GROWTH BY YR CUFT         Standard report.
Report # = 12   OWNER GROWTH BY YR BDFT         Standard report.
Report # = 13   GROWTH/VOLUME CUFT              Standard report.
Report # = 14   GROWTH/VOLUME BDFT
Report # = 15   GROWTH/CUT CUFT
Report # = 16   GROWTH/CUT BDFT
Report # = 17   CUT/INVENTORY CUFT
Report # = 18   CUT/INVENTORY BDFT
Report # = 19   STUMPAGE REVENUE BY OWNER

Enter code (1 or 2):
    1) to select standard reports
    2) to select individual, desired reports     >> 2
```

NOTE: The version of MTMM available to Data General users has no maximum report number constrain.

By entering a "1", MTMM will produce a set of "standard reports," Reports 1-13. If a "2" is entered, the following will appear:

```
Enter the desired report numbers (eg. 3,7)>> 1,3,4,10
```

The following is a brief summary of what is contained in each report. Monetary values found in all reports are in 1985 dollars.

Report #1: State Summary Page 1—Lists total growing stock MCF (thousand cubic feet), total growing stock MBF (thousand board feet), northwest regional harvest MBF, southwest regional harvest MBF, central regional harvest MBF, other statewide harvest MBF, and total statewide harvest MBF.

Report #2: State Summary Page 2—Lists statewide stumpage price (1985 $), statewide stumpage index (1985=100), lumber and wood products price index (1967=100), manufacturing, logging, and hauling costs (1967 $), overrun, and total statewide revenue (thousands 1985 $).

Report #3: Owner Volume Cut by Yr BDFT—Lists volume cut by owner by year in board foot Scribner.

Report #4: Owner Shortfall by YR BDFT—Lists shortfall by owner by year (MMBF [million board feet]). Shortfall occurs when the required harvest on an owner/area is greater than the inventory.

Report #5: Processing vs. Delivery—Lists the regional and State processing levels and the actual log deliveries to regions and State.

Report #6: Employment & Income Regional—Lists the estimated employment and income by region.

Report #7: Employment & Income Totals—Lists the estimated employment and income for the State.

Report #8: Owner Growing Stock by DBH—Lists the inventory in 10-year intervals by owner/area by d.b.h. class for a single year. This report is long—18 pages.

The last 11 reports are by owner, substate region, and year.

Report #9: Owner Inventory by Yr CUFT—Lists the inventory in millions of cubic feet.

Report #10: Owner Inventory by Yr BDFT—Lists the inventory in millions of board feet.

Report #11: Owner Growth by YR CUFT—Lists timber growth in thousands of cubic feet.

Report #12: Owner Growth by Yr BDFT—Lists timber growth in thousands of board feet.

Report #13: Growth/Volume CUFT—Lists the ratio of cubic-foot growth to total cubic-foot volume.

Report #14: Growth/Volume BDFT—Lists the ratio of board-foot growth to total board-foot volume.

Report #15: Growth/Cut CUFT—Lists the ratio of cubic-foot growth to the volume cut in cubic feet.

Report #16: Growth/Cut BDFT—Lists the ratio of board-foot growth to the volume cut in board feet.

Report #17: Cut/Inventory CUFT—Lists the ratio of volume cut in cubic feet to the total inventory in cubic feet.

Report #18: Cut/Inventory BDFT— Lists the ratio of volume cut in board feet to the total inventory in board feet.

Report #19: Stumpage Revenue by Owner—Lists the stumpage revenue by owner in thousands of dollars adjusted to 1985 dollars.

Once the output reports have been selected they will be listed to the screen for verification:

```
The follows reports will be produced:

Report # =  1   STATE SUMMARY PAGE 1
Report # =  3   OWNER VOLUME CUT BY YR BDFT
Report # =  4   OWNER SHORTFALL BY YR BDFT
Report # = 10   OWNER INVENTORY BY YR BDFT

Enter (1) if reports are correct or (2) to reenter reports >> 1
```

After desired reports are selected the program asks the user to specify an output file to which the reports will be summarized. If the user is running MTMM on a PC, the following instructions will appear on the screen:

```
Enter a "Return" to use the default output file name REPORT.LST.
(Check the DOS manual for rules about naming files.)

Enter output file name (eg. RUN123.LST) >> MTMM#7.LST
```

The following instructions will appear on the screen for Data General users:

```
Enter output file name  >> RUN19.LST
```

The final report will be written to the file specified, in this case called RUN19.LST. Once the output file name has been entered, the screen will clear and the following will appear:

```
MTMM RUNNING
```

When MTMM is finished running, the following message will appear on the screen:

```
****** Reports are written to a file named MTMM#7.LST    ******

                        MTMM FINISHED
```

Finally, the report file is printed with the proper print command (that is, PC = PRINT RUN 19.LST).

NOTE: Output files are formatted for wide, computer-output-sized paper.

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